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(71)Applicant : RICOH CO LTD

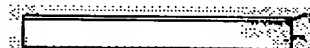
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(72)Inventor : TEZUKA SHINJI
IWABUCHI TOSHIKI**(54) ARRANGEMENT METHOD OF MINUTE SUBSTANCES AND FORMING METHOD OF CONNECTION STRUCTURE EMPLOYING THE ARRANGEMENT METHOD****(57)Abstract:**

PROBLEM TO BE SOLVED: To provide an arrangement method which enables fine arrangement of minute substances easily and securely, and provide the forming method of a connection structure which enables the highly reliable connection of fine pattern pitch electrodes with conductive substances which are arranged by the arrangement method.

SOLUTION: An ultraviolet radiation 4 is applied to an ultraviolet curing adhesive layer 2 formed on a substrate 1 by using a mask 3 to cure the adhesive layer 2. Then, minute substances 5 are brought into contact with the whole surface of the adhesive layer 2 and bonded to the parts of the adhesive layer 2 to which the ultraviolet radiation 4 is not applied. The unnecessary minute substances on the substrate 1 are removed. Or, a transparent substrate 1 may be employed and, after the minute substances 5 are arranged on the adhesive layer 2, the ultraviolet radiation 4 may be applied to the rear side of the substrate 1. Or, a patterned photoresist layer may be used as the adhesive layer 2. Further, by utilizing the above mentioned arrangement method, conductive particles are arranged on electrodes of a wiring board only and the other electrodes are connected to the electrodes of the board with the conductive particles therebetween to obtain a highly reliable connection structure.

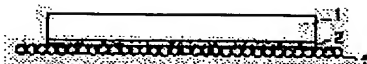
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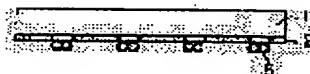
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(71)出願人 000006747

株式会社リコー

東京都大田区中馬込1丁目3番6号

(72)発明者 手塚 伸治

東京都大田区中馬込1丁目3番6号 株式
会社リコー内

(72)発明者 岩渕 寿章

東京都大田区中馬込1丁目3番6号 株式
会社リコー内

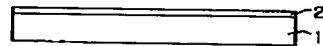
(54)【発明の名称】 微小物体の配列方法及び該配列方法を用いた接続構造の形成方法

(57)【要約】

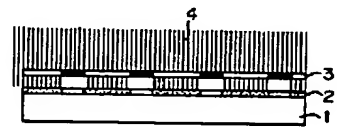
【課題】 微小物体の微細な配列を容易かつ確実にこなうことのできる配列方法と、この配列方法を利用して配列させた導電体により、微細な電極パターンピッチでも信頼性の高い接続を行うことのできる接続構造の形成方法を提供する。

【解決手段】 基体1に設けた紫外線硬化型粘着層2にマスク3を用いて紫外線4を照射し、粘着層2を硬化させる工程と、粘着層2の全面に微小物体5を接触させ、紫外線の非照射部分に粘着させる工程と、基体1上の不要の微小物体を除去する工程を有するようにする。また基体1を透明なものにし、粘着層2に微小物体5を配した後に、基体1の背面側から紫外線を照射してもよく、粘着層2にパタン化したフォトリソストを用いてもよい。また、上記の配列方法を利用して、図示しない配線基板の電極上のみ導電粒子を配置し、この導電粒子を介して他の電極と接続させることにより、高い信頼性を持つ接続構造を得るようにする。

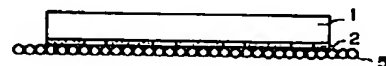
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【特許請求の範囲】

【請求項1】 基体上に設けた紫外線硬化型樹脂からなる粘着層の一部に紫外線を照射し、該照射部分の前記粘着層を硬化させて粘着力を低下させる工程と、前記粘着層の全面に微小物体を接触させ、前記紫外線の非照射部分に前記微小物体を粘着させて配列する工程と、前記照射部分に付着した不要の微小物体を除去する工程を有することを特徴とする微小物体の配列方法。

【請求項2】 透明な基体上に設けた紫外線硬化型樹脂からなる粘着層の全面に微小物体を粘着させる工程と、前記粘着層の一部に前記基体の背面側から前記粘着層の一部に紫外線を照射し、該照射部分の前記粘着層を硬化させて粘着力を低下させる工程と、前記照射部分の前記微小物体を除去して前記紫外線の非照射部分に前記微小物体を配列する工程を有することを特徴とする微小物体の配列方法。

【請求項3】 基体上に設けたフォトレジスト層をフォトリソグラフィによりパタン化する工程と、前記パタン化されて前記基体上に残留した前記フォトレジスト層を粘着層として、該粘着層に微小物体を粘着させて配列する工程を有することを特徴とする微小物体の配列方法。

【請求項4】 透明な第1の基体上に設けた紫外線硬化型樹脂からなる第1の粘着層の全面に微小物体を粘着させる工程と、前記第1の粘着層より低粘着力の第2の粘着層を設けた第2の基体と前記微小物体を粘着させた前記第1の基体とを重ね合わせる工程と、重ね合わせた前記第1の基体の背面側から前記第1の粘着層の一部に紫外線を照射し、該照射部分の第1の粘着層を硬化させて粘着力を低下させる工程と、前記第2の基体から前記第1の基体を剥離して前記第1の基体上の前記照射部分の微小物体を前記第2の基体上に転写して配列させる工程を有することを特徴とする微小物体の配列方法。

【請求項5】 第1の配線基板上の電極端子と第2の配線基板上の電極端子とを導電体を介して電気的に接続させるようにした接続構造の形成方法において、前記第1の配線基板と前記第2の配線基板は、前記各配線基板間に充填された第1の接着剤によって固定され、前記導電体は前記電気的に接続をする領域にのみ存在させるようにし、前記各電極端子の少なくとも一方に設けられた第2の接着剤により固定されるようにすることを特徴とする接続構造の形成方法。

【請求項6】 請求項5記載の接続構造の形成方法において用いる電極端子に導電体が配された前記第1又は第2いずれかの配線基板を得る工程として、請求項1～3いずれか1記載の微小物体の配列方法により、前記微小物体に該当する導電体を第1の粘着層を設けた第1の基体上に配列する工程と、前記第1の粘着層よりも高粘着力の第2の粘着層が設けられた第2の基体と前記導電体が配列した前記第1の基体とを重ね合わせ、前記第2の

粘着層の粘着力により前記導電体を前記第2の基体に転写する工程と、表面に接着剤が設けられた電極端子を備える前記配線基板と前記導電体が転写された前記第2の基体とを重ね合わせ、前記接着剤の接着力により前記導電体を前記電極端子上に転写して配列させる工程を有するようにすることを特徴とする接続構造の形成方法。

【請求項7】 請求項5記載の接続構造の形成方法において用いる電極端子に導電体が配された前記第1又は第2いずれかの配線基板を得る工程として、請求項4記載の微小物体の配列方法により、前記微小物体に該当する導電体を前記第2の基体上に配列する工程と、表面に接着剤が設けられた電極端子を備える前記第1の配線基板と前記導電体が配列した前記第2の基体とを重ね合わせ、前記接着剤の接着力により前記導電体を前記電極端子上に転写して配列させる工程を有するようにすることを特徴とする接続構造の形成方法。

【請求項8】 請求項6または7記載の接続構造の形成方法において、前記第2の基体が透明であり、前記第2の粘着層が紫外線硬化型樹脂からなり、前記転写時に紫外線を照射して前記第2の粘着層の粘着力を低下させ、前記転写を容易に行うようにすることを特徴とする接続構造の形成方法。

【請求項9】 請求項5記載の接続構造の形成方法において用いる電極端子に導電体が配された前記第1又は第2いずれかの配線基板を得る工程として、請求項1または2記載の微小物体の配列方法により、透明な基体上に前記微小物体に該当する導電体を配列する工程と、表面に接着剤が設けられた電極端子を備える前記配線基板と前記導電体が配列した前記基体とを重ね合わせ、前記基体の背面側から紫外線を照射して前記粘着層を硬化させて粘着力を低下させ、前記導電体を前記電極端子上に転写して配列させる工程を有するようにすることを特徴とする接続構造の形成方法。

【請求項10】 請求項8または9記載の接続構造の形成方法において、前記接着剤を紫外線硬化型接着剤とし、前記転写時に照射する紫外線により前記導電粒子と前記接着剤を強固に接着させるようにすることを特徴とする接続構造の形成方法。

【発明の詳細な説明】

【0001】

【発明の属する技術分野】この発明は、微小物体を目的の位置に配列させる方法に関し、より詳細には、2枚の電気回路基板上の対向する電極端子位置に導電体を配し、両者の電気的接続を行う方法に関するものである。微小物体を配列させる方法については、例えば、配列するものとしてトナーを用いることにより、画像形成装置への応用ができるものである。

【0002】

【従来の技術】図6は、従来技術による電極パターンの接続構造を示す断面図で、図中、11は第1の配線基

板、12は第2の配線基板、13、14は電極、15は導電粒子、16、17は接着剤である。図6に示すように、従来、微細な電極パターン同士を接合する際には、接触加圧部のみに導電性を示す異方性導電材料が用いられている。例えば特公平3-40899号公報に開示されている回路の接続構造体は、導電性粒子を絶縁性接着剤中に混合させたものを基板間に挿入し、両基板の電極で導電性粒子を挟み、加圧された部分で電氣的な接続を行うようにしたものである。このような接続方式では、接続ピッチが狭くなると、基板間に存在し本来接続に寄与しない導電粒子の横方向の接触が起きやすくなり、短絡が生じてしまうという問題点があった。

【0003】そこで、特開平4-292803号公報に開示された異方導電性フィルムでは、接続材料として絶縁性被覆を持ち、導電粒子を内包した樹脂を分散配合したフィルムを用いている。この接続材料は、未加圧状態では導電性を示さないために、接続ピッチが微細化して接続材料同士が接触することになっても短絡することがない。しかしながら、この構造においては、接続材料を形成する工程が複雑であり、その製造コストも高くなるという問題点が生じる。

【0004】また、この他先行技術の例として、所定の位置に貫通孔を有するマスクを表面粘性を有する部材上に密着させ、導電粒子を前記貫通孔内に入れた後にマスクを分離して導電粒子を配列し、その後に電極端子上に転写するようにしたものがあり、これにより、導電粒子は電極上にのみ配列されるので、横方向の短絡は起きない。しかしながら、導電粒子として樹脂粒子表面に金属膜を形成したものをを用いているため、マスクの貫通孔内に粒子を入れる工程中に貫通孔端面や粒子移動手段端面等が導電粒子に接触することにより、前記金属膜の破壊もしくは剥離が生じ、接続不良が発生することがある。

【0005】

【発明が解決しようとする課題】本発明は、上述のような実情に鑑みてなされたもので、微小物体の微細な配列を容易かつ確実にこなうことのできる配列方法と、この配列方法を利用して配列させた導電体により、微細な接続ピッチでも安価に歩留まりよく、かつ信頼性の高い接続を行うことのできる電極パターンの接続構造の形成方法を提供することをその解決すべき課題とする。

【0006】

【課題を解決するための手段】請求項1の発明は、基体上に設けた紫外線硬化型樹脂からなる粘着層の一部に紫外線を照射し、該照射部分の前記粘着層を硬化させて粘着力を低下させる工程と、前記粘着層の全面に微小物体を接触させ、前記紫外線の非照射部分に前記微小物体を粘着させて配列する工程と、前記照射部分に付着した不要の微小物体を除去する工程を有することを特徴としたものである。

【0007】請求項2の発明は、透明な基体上に設けた

紫外線硬化型樹脂からなる粘着層の全面に微小物体を粘着させる工程と、前記粘着層の一部に前記基体の背面側から前記粘着層の一部に紫外線を照射し、該照射部分の前記粘着層を硬化させて粘着力を低下させる工程と、前記照射部分の前記微小物体を除去して前記紫外線の非照射部分に前記微小物体を配列する工程を有することを特徴としたものである。

【0008】請求項3の発明は、基体上に設けたフォトリソグレイス層をフォトリソグラフィーによりパターン化する工程と、前記パターン化されて前記基体上に残留した前記フォトリソグレイス層を粘着層として、該粘着層に微小物体を粘着させて配列する工程を有することを特徴としたものである。

【0009】請求項4の発明は、透明な第1の基体上に設けた紫外線硬化型樹脂からなる第1の粘着層の全面に微小物体を粘着させる工程と、前記第1の粘着層より低粘着力の第2の粘着層を設けた第2の基体と前記微小物体を粘着させた前記第1の基体とを重ね合わせる工程と、重ね合わせた前記第1の基体の背面側から前記第1の粘着層の一部に紫外線を照射し、該照射部分の第1の粘着層を硬化させて粘着力を低下させる工程と、前記第2の基体から前記第1の基体を剥離して前記第1の基体上の前記照射部分の微小物体を前記第2の基体上に転写して配列させる工程を有することを特徴としたものである。

【0010】請求項5の発明は、第1の配線基板の電極端子上と第2の配線基板の電極端子上とを導電体を介して電氣的に接続させるようにした接続構造の形成方法において、前記第1の配線基板と前記第2の配線基板は、前記各配線基板間に充填された第1の接着剤によって固定され、前記導電体は前記電氣的に接続をする領域にのみ存在させるようにし、前記各電極端子の少なくとも一方に設けられた第2の接着剤により固定されるようにすることを特徴としたものである。

【0011】請求項6の発明は、請求項5記載の接続構造の形成方法において用いる電極端子上に導電体が配された前記第1又は第2いずれかの配線基板を得る工程として、請求項1～3いずれか1記載の微小物体の配列方法により、前記微小物体に該当する導電体を第1の粘着層を設けた第1の基体上に配列する工程と、前記第1の粘着層よりも高粘着力の第2の粘着層が設けられた第2の基体と前記導電体が配列した前記第1の基体とを重ね合わせ、前記第2の粘着層の粘着力により前記導電体を前記第2の基体に転写する工程と、表面に接着剤が設けられた電極端子を備える前記配線基板と前記導電体が転写された前記第2の基体とを重ね合わせ、前記接着剤の粘着力により前記導電体を前記電極端子上に転写して配列させる工程を有するようにすることを特徴としたものである。

【0012】請求項7の発明は、請求項5記載の接続構

造の形成方法において用いる電極端子に導電体が配された前記第1又は第2いずれかの配線基板を得る工程として、請求項4記載の微小物体の配列方法により、前記微小物体に該当する導電体を前記第2の基体上に配列する工程と、表面に接着剤が設けられた電極端子を備える前記第1の配線基板と前記導電体が配列した前記第2の基体とを重ね合わせ、前記接着剤の接着力により前記導電体を前記電極端子上に転写して配列させる工程を有するようにすることを特徴としたものである。

【0013】請求項8の発明は、請求項6または7記載の接続構造の形成方法において、前記第2の基体が透明であり、前記第2の粘着層が紫外線硬化型樹脂からなり、前記転写時に紫外線を照射して前記第2の粘着層の粘着力を低下させ、前記転写を容易に行うようにすることを特徴としたものである。

【0014】請求項9の発明は、請求項5記載の接続構造の形成方法において用いる電極端子に導電体が配された前記第1又は第2いずれかの配線基板を得る工程として、請求項1または2記載の微小物体の配列方法により、透明な基体上に前記微小物体に該当する導電体を配列する工程と、表面に接着剤が設けられた電極端子を備える前記配線基板と前記導電体が配列した前記基体とを重ね合わせ、前記基体の背面側から紫外線を照射して前記粘着層を硬化させて粘着力を低下させ、前記導電体を前記電極端子上に転写して配列させる工程を有するようにすることを特徴としたものである。

【0015】請求項10の発明は、請求項8または9記載の接続構造の形成方法において、前記接着剤を紫外線硬化型接着剤とし、前記転写時に照射する紫外線により前記導電粒子と前記接着剤を強固に接着させるようにすることを特徴としたものである。

【0016】

【発明の実施の形態】以下に、本発明が適用される微小物体の配列方法及び接続構造の形成方法の実施形態を添付された図面を参照して具体的に説明する。なお、実施形態を説明するための全図において、同一機能を有するものは同一符号を付け、その繰り返しの説明は省略する。図1は、請求項1の発明を説明するための図で、微小物体の配列方法の一実施形態の断面図を工程に従って示すものである。図中、1は基体、2は紫外線硬化型樹脂層（粘着層）、3はマスク、4は紫外線、5は微小物体である。図1（A）に示すごとく、紫外線硬化型樹脂層2を有する粘着部材（例えば、古河電気工業株式会社製ダイシングテープ（UC1827））を用意し、これに図1（B）に示すごとく、紫外線透過部と遮閉部を設けたマスク3を介して紫外線4を規定量以上照射する。これにより、紫外線を照射された部分の紫外線硬化型樹脂層2は硬化して粘着性を失う。この状態で、図1（C）に示すごとく、紫外線硬化型樹脂層2側全面に微小物体5を配置し、軽く圧力を加えるか、もしくは微小物体5がた

められている部分に前記粘着部材を押し当てる。これにより、紫外線非照射部に、紫外線硬化型樹脂層2が本来の有する粘着力により微小物体5が固定される。紫外線照射部にも一部微小物体は付着することがあるが、粘着面に対して軽くエアブローもしくは振動を与えることにより除去することができる。従って、これらの工程を経た後には、図1（D）に示すごとく、前記粘着部材の紫外線非照射部のみに微小物体5を固定することができる。ここで、紫外線硬化型樹脂層2は、粘着力があるためにマスク3を離して照射するのが通常であり、半導体プロセスで用いるステッパーを用いることが好ましい。

【0017】また、前述したダイシングテープは、通常基材表面に塗工形成した紫外線硬化型樹脂層上にセパレーターを貼り合わせた3層構造になっている。従って、セパレーターを剥離することなく、セパレーター上にマスクを密着させた状態で紫外線を照射する方法を採用することにより、マスクと紫外線硬化型樹脂層との間隔がほぼ一定となるので、特別な装置を必要とせず、一定のパターン形成を行うことができる。また、このようなダイシングテープの基材自体も透明であるために、粘着面の背面から同様に照射することによっても同様な効果を得ることができる。

【0018】図2は、請求項2記載の発明を説明するための図で、微小物体の配列方法の他の実施形態の断面図を工程に従って示すものである。ここでは、図1に示した実施形態と同様の粘着部材を用い、該粘着部材が有する紫外線硬化型樹脂層2の全面に微小物体5を配置するか、もしくは一面に微小物体5を敷きつめて、ここに該部材を押し当てる。これにより、図2（B）に示すごとく、紫外線硬化型樹脂層2の全面に微小物体5が付着した状態となる。ついで、図2（C）に示すごとく、この粘着面の背面よりマスク3を介して紫外線4を規定量照射する。これにより、紫外線は透明な基体1を透過して、紫外線硬化型樹脂層2に達し、照射部の該樹脂層は硬化して、粘着力を失うことになる。この状態で、紫外線硬化型樹脂層2の表面に対してエアブローもしくは振動を与えることにより、照射領域に付着した微小物体5を除去することができる。従って、これらの工程を経た後には、図2（D）に示すごとく、粘着部材上の紫外線非照射部のみに微小物体5を固定し配列することができる。

【0019】図3は、請求項3の説明するための図で、微小物体の配列方法の更に他の実施形態の断面図を工程に従って示すものである。図中、1'は基板、6はレジスト層である。まず、図3（A）に示すごとく、ガラス等の粘着力を持たない基板1'の上にフォトリジスト層6を形成する。このときのフォトリジストとしては、エマルジョン系のものが望ましく、例えば、東京応化株式会社製BMRレジストがあげられる。次に、図3（B）及び図3（C）に示すごとく、このフォトリジスト

ト層6をフォトリソグラフィープロセスにより微小物体を配列させたい位置のみにレジスト領域を残すようにパターン化する。図3(D)に示すごとく、こうして形成した基板1'の全面に微小物体5を配置するか、もしくは一面に微小物体5が敷き詰められた部分へ基板1'を押し当てる。同種のフォトレジストは多少の粘着力を有するために、図3(E)に示すごとく、フォトレジスト部のみに微小物体を配列保持することができる。

【0020】図4は、請求項4を説明するための図で、微小物体の配列方法の更に他の実施形態の断面図を工程に従って示すものである。図中、7は第2の粘着部材である。ここでは、図4(A)に示すごとく、図1に示した実施形態と同様の粘着部材を用意し、図4(B)に示すごとく、紫外線硬化型樹脂層2の全面に微小物体を配置するか、もしくは一面に微小物体が敷き詰められた部分へ前記粘着部材を押し当てる。これにより、紫外線硬化型樹脂層2の全面に微小物体が付着した状態となる。この粘着部材は、前述したように基体1が透明であり、この状態で、図4(C)に示すごとく、前記粘着部材よりも弱い粘着力を有する第2の粘着部材7を押し当てる。この粘着部材7に適した材料として、具体的にはシリコンゴムがあげられる。ここで、紫外線硬化型樹脂層2の全面に、微小粒子5を配列させる部分にのみ基体1の背面から紫外線4を規定量照射する。これにより、照射部の紫外線硬化型樹脂層2は硬化して粘着力を失う。その後、図4(D)に示すごとく、両者を分離すると、紫外線非照射部の微小物体5は紫外線硬化型樹脂層2に付着したままであるが、紫外線照射部の微小物体5は、第2の粘着部材7側へ転写され、結果として第2の粘着性部材6の上へ微小物体を配列することができる。

【0021】配列工程の1サイクルは、ここで終了するが、第2の粘着部材7上に配列した微小物体5を他の場所に移動させ、図4(E)ないし図4(G)に示すごとく、再び基体1に押し当て、ここで、マスク3の位置をずらして紫外線4の照射を行うことにより、同様の配列を第2の粘着部材7上に形成させることができる。このような方法により、微小物体5の利用効率を高めることが可能となる。

【0022】図5は、請求項5を説明するための電極パターンの接続構造を示す断面図で、図中、図6と同じ作用をする部分には、図6と同じ符号が付してある。第1の配線基板11及び第2の配線基板12は、各基板面に対して凸形状の互いに接続されるべき電極13、14を持つ。これらの電極表面の少なくとも一方には、接着剤層16が設けられていて、この接着剤層16により両電極に挟まれる形で導電性粒子15が固定されている。これら基板間のその他の間隙部分には、絶縁性の接着剤17が充填されており、これにより両基板が接合されている。このとき、導電性粒子15は接続されるべき電極13、14の上にのみ存在するような構造となっている。

このような構造では、電極間隔を狭めても横方向の電氣的接触は起きにくい。

【0023】請求項1から4記載の配列方法を用いることにより配列部材(粘着層を設けた基体)上に配列された導電粒子(微小物体)を、該配列部材の粘着力より大きな粘着力を持つ転写部材(第2の粘着層を設けた基体)と重ねた後に分離することにより、両者の粘着力の差によって導電粒子は転写部材側へ転写する。そしてこの導電粒子が配列した転写部材を基板の電極上に導電性粒子がくるように位置決めした後に、該転写部材と該基板とを重ね合わせる。その状態で電極表面に形成されている接着剤の硬化を行うなどして転写部材上の導電粒子を電極上に固定する。この後、基板と転写部材を分離することにより電極上に導電粒子を配列することができる。このとき、請求項8に示すように転写部材として前述したようなダイシングテープを用い、電極上に重ねた後に粘着面の背面側から紫外線を照射することにより、電極上へ容易に転写することができる。

【0024】上記配列部材としてダイシングテープを用いてその上に導電粒子を配列させた後、直接基板の電極上に重ね合わせた後に裏面から紫外線を照射することで、配列部材全面の樹脂は硬化するために、電極上へ導電粒子が転写される。この方法により、転写部材及び転写工程を省くことができる(請求項9)。

【0025】電極上に紫外線照射を行なって導電粒子を転写する際に、電極上に紫外線硬化型の接着剤を塗布しておく。これにより、転写時に紫外線照射を行うことにより電極上の接着剤が硬化し、導電粒子を確実に固定することができる(請求項10)。

【0026】

【発明の効果】

請求項1、2の効果：紫外線を照射することにより粘着層の粘着力を制御して、微小物体を配する方法であるので、紫外線の照射パターンで微小物体の配列を決定できるので、容易に、かつ確実に微小物体を配列することができる。

【0027】請求項3の効果：フォトリソグラフィーにより粒子を配列させる領域を形成するので、より微細な配列を実現することができる。

【0028】請求項4の効果：全面に微小物体が配された基体上の紫外線照射部のみの微小物体を転写・配列に利用するようにしているので、紫外線照射時に基体をずらしながら転写を行なうことにより、同一の基体で複数回の転写・配列が可能であり、粒子の利用効率を高めることができる。

【0029】請求項1ないし4の効果：微小物体の配列を基体上の面内で一括して形成することができるので、配列の形状、配列させる物体の数に関わらず、同一の工程で配列を得ることができる。

【0030】請求項5の効果：接続すべき電極上にのみ

導電体が存在するようにしているので、接続ピッチが微細になっても短絡することがなく、高密度の接続を実現できる。

【0031】請求項6の効果：紫外線照射工程を経て第1の基体上に配列した導電粒子を第2の基体上に転写したのち電極上に再度転写するようにしているため、第1の基体が1枚で複数回の転写を行うことができ、製造コストを低減することができる。

【0032】請求項7の効果：請求項4記載の配列方法を利用しているので、全面に付着させた粒子を複数回の配列形成に利用でき、粒子の利用効率が高く、実装コストを低減することができる。

【0033】請求項8の効果：電極上に導電粒子を転写する際に、導電粒子が配列されている基体に紫外線照射を行なうことにより、導電粒子の保持力が弱まるので、より確実に電極上に導電粒子を配列することができる。

【0034】請求項9の効果：導電粒子が配列させている基体を直接基板上に重ねて導電粒子を電極上に転写するため、転写するための第2の基体が省略でき、またこれを使用した転写工程の削減が行えるので、製造コストを低減することができる。

【0035】請求項10の効果：電極上に塗布する接着剤が紫外線硬化型であるので、導電粒子の転写時に紫外線照射を行って接着剤を硬化させることにより、導電粒子が電極上に確実に固定され、信頼性の高い接続構造を

得ることができる。

【図面の簡単な説明】

【図1】 請求項1の発明を説明するための図で、微小物体の配列分法の一実施形態の断面図を工程に従って示すものである。

【図2】 請求項2記載の発明を説明をするための図で、微小物体の配列方法の他の実施形態の断面図を工程に従って示すものである。

【図3】 請求項3の説明をするための図で、微小物体の配列方法の更に他の実施形態の断面図を工程に従って示すものである。

【図4】 請求項4を説明するための図で、微小物体の配列方法の更に他の実施形態の断面図を工程に従って示すものである。

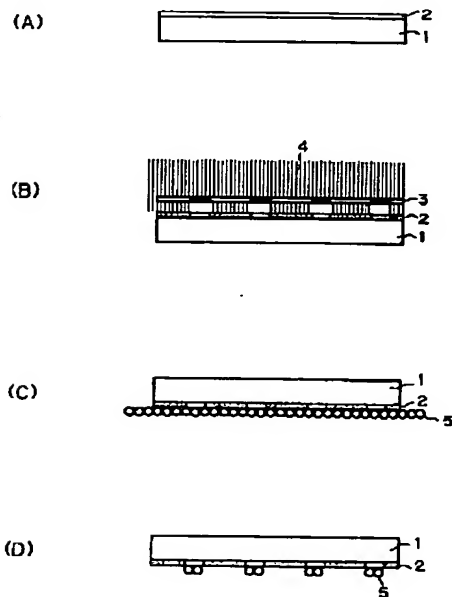
【図5】 請求項5を説明するための電極パターンの接続構造を示す断面図である。

【図6】 従来技術による電極パターンの接続構造を示す断面図である。

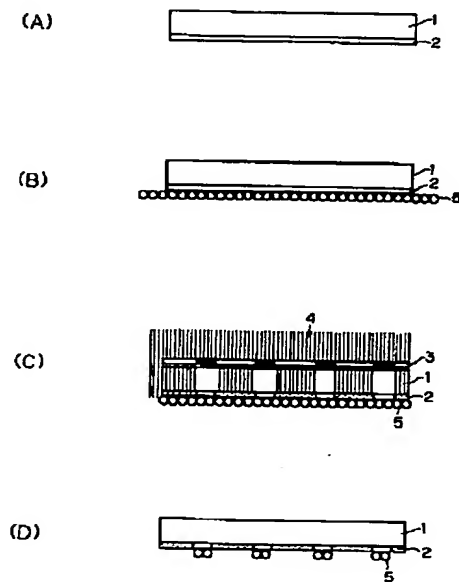
【符号の説明】

1…基体、1'…基板、2…紫外線硬化型樹脂層（粘着層）、3…マスク、4…紫外線、5…微小物体、6…レジスト層、7…第2の粘着部材、11…第1の配線基板、12…第2の配線基板、13、14…電極、15…導電粒子、16、17…接着剤。

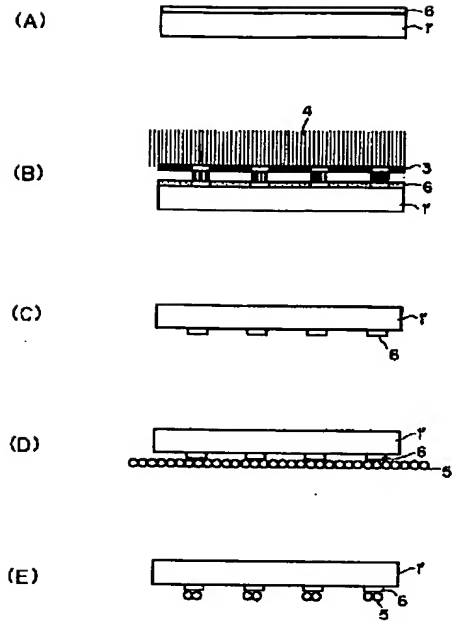
【図1】



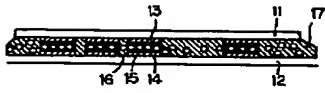
【図2】



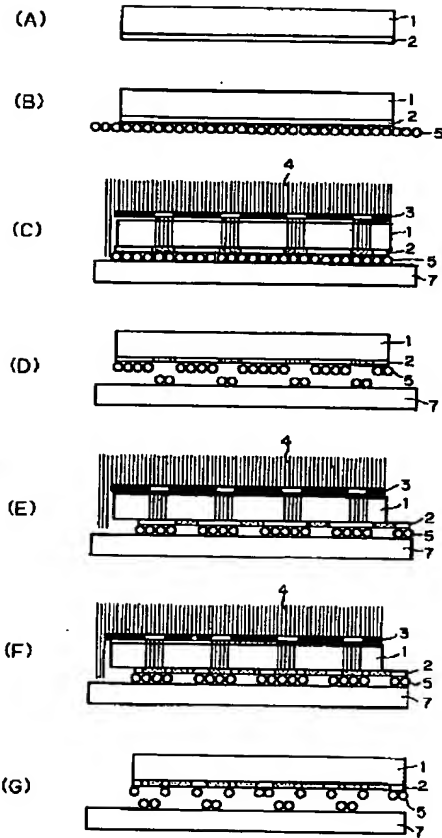
【図3】



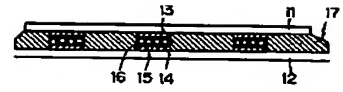
【図6】



【図4】



【図5】



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CLAIMS

[Claim(s)]

[Claim 1] An array method of a minute body characterized by providing the following A production process at which ultraviolet rays are irradiated at a part of adhesive layer which consists of ultraviolet curing mold resin prepared on a base, said adhesive layer of this exposure portion is stiffened, and adhesion is reduced A production process which contact a minute body all over said adhesive layer, and said minute body is made to adhere to a non-glaring portion of said ultraviolet rays, and is arranged A production process which removes an unnecessary minute body adhering to said exposure portion

[Claim 2] An array method of a minute body characterized by providing the following A production process to which a minute body is made to adhere all over an adhesive layer which consists of ultraviolet curing mold resin prepared on a transparent base A production process at which ultraviolet rays are irradiated from a back side of said base at said a part of adhesive layer at said a part of adhesive layer, said adhesive layer of this exposure portion is stiffened, and adhesion is reduced A production process which removes said minute body of said exposure portion, and arranges said minute body into a non-glaring portion of said ultraviolet rays

[Claim 3] An array method of a minute body characterized by having a production process which pattern-izes with photolithography a photoresist layer prepared on a base, and a production process which a minute body is made to adhere to this adhesive layer by using as an adhesive layer said said photoresist layer which was pattern-ized and remained on said base, and is arranged.

[Claim 4] An array method of a minute body characterized by providing the following A production process to which a minute body is made to adhere all over the 1st adhesive layer which consists of ultraviolet curing mold resin prepared on the 1st transparent base A production process which piles up the 2nd base which prepared the 2nd adhesive layer of low adhesion from said 1st adhesive layer, and said 1st base to which said minute body was made to adhere A production process at which ultraviolet rays are irradiated from a back side of said 1st base made to pile up mutually at said a part of 1st adhesive layer, the 1st adhesive layer of this exposure portion is stiffened, and adhesion is reduced A production process which said 1st base is exfoliated [production process] from said 2nd base, and makes a minute body of said exposure portion on said 1st base imprint and arrange on said 2nd base

[Claim 5] In a formation method of connection structure to which it was made to connect electrically an electrode terminal on the 1st wiring substrate, and an electrode terminal on the 2nd wiring substrate through a conductor Said 1st wiring substrate and said 2nd wiring substrate It is the formation method of connection structure characterized by making it fixed by the 2nd adhesives which it was fixed by the 1st adhesives with which it filled up between said each wiring substrate, is made to make said conductor exist only in said field which connects electrically, and were formed at least in one side of each of said electrode terminal.

[Claim 6] A formation method of connection structure characterized by making it have a production process which said conductor is imprinted [production process] on said electrode terminal by adhesive strength of superposition and said adhesives, and makes said wiring substrate equipped with an electrode terminal characterized by providing the following, and said 2nd base with which said conductor was

imprinted arrange A production process which arranges a conductor applicable to said minute body on the 1st base which prepared the 1st adhesive layer by the array method of a minute body claim 1 - given [any 1] in three as a production process which obtains said the 1st or 2nd one of wiring substrates with which a conductor was arranged on an electrode terminal used in a formation method of connection structure according to claim 5 A production process which imprints said conductor for the 2nd base with which the 2nd adhesive layer of high adhesion was prepared rather than said 1st adhesive layer, and said 1st base which said conductor arranged to said 2nd base according to adhesion of superposition and said 2nd adhesive layer They are adhesives to the surface.

[Claim 7] A formation method of connection structure characterized by making it have a production process which said conductor is imprinted [production process] on said electrode terminal by adhesive strength of superposition and said adhesives, and makes the 1st [said] wiring substrate equipped with an electrode terminal characterized by providing the following, and said 2nd base which said conductor arranged arrange A production process which arranges a conductor applicable to said minute body on said 2nd base by the array method of a minute body according to claim 4 as a production process which obtains said the 1st or 2nd one of wiring substrates with which a conductor was arranged on an electrode terminal used in a formation method of connection structure according to claim 5 They are adhesives to the surface.

[Claim 8] A formation method of connection structure characterized by said 2nd base being transparent, and said 2nd adhesive layer consisting of ultraviolet curing mold resin in a formation method of connection structure according to claim 6 or 7, irradiating ultraviolet rays at the time of said imprint, reducing adhesion of said 2nd adhesive layer, and performing said imprint easily.

[Claim 9] The formation method of the connection structure characterized by making it have a production process which ultraviolet rays are irradiated [production process] to said wiring substrate equipped with an electrode terminal characterized by to provide the following, and said base which said conductor arranged from a superposition and back side of said base, stiffens said adhesive layer, reduces adhesion, and makes said conductor imprint and arrange on said electrode terminal A production process which arranges a conductor applicable to said minute body on a transparent base by the array method of a minute body according to claim 1 or 2 as a production process which obtains said the 1st or 2nd one of wiring substrates with which a conductor was arranged on an electrode terminal used in a formation method of connection structure according to claim 5 They are adhesives to the surface.

[Claim 10] A formation method of connection structure which uses said adhesives as ultraviolet curing mold adhesives, and is characterized by making it paste up said electric conduction particle and said adhesives firmly by ultraviolet rays which glare at the time of said imprint in a formation method of connection structure according to claim 8 or 9.

[Translation done.]

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[The technical field to which invention belongs] This invention arranges a conductor on the electrode terminal location where details are countered more on two electrical circuit substrates about the method of making the target location arranging a minute body, and relates to the method of performing both electrical installation. About the method of making a minute body arranging, application to image formation equipment can be performed by, for example, using a toner as what is arranged.

[0002]

[Description of the Prior Art] Drawing 6 is the cross section showing the connection structure of the electrode pattern by the conventional technology, and, for the 1st wiring substrate and 12, as for an electrode and 15, an electric conduction particle, and 16 and 17 are [the 2nd wiring substrate, and 13 and 14 / 11] adhesives among drawing. As shown in drawing 6, in case detailed electrode patterns are joined conventionally, the anisotropy electrical conducting material in which conductivity is shown is used only for the contact pressurization section. For example, the connection structure of the circuit currently indicated by JP,3-40899,B inserts between substrates what mixed the conductive particle in insulating adhesives, sandwiches a conductive particle with the electrode of both substrates, and is made to make electric connection in the pressurized portion. In such a connection type, when the connection pitch became narrow, contact of the longitudinal direction of the electric conduction particle which exists between substrates and originally does not contribute to connection becomes easy to occur, and there was a trouble that a short circuit will arise.

[0003] So, with the different direction conductivity film indicated by JP,4-292803,A, it has insulating covering as a connection material, and the film which carried out distributed combination of the resin which connoted the electric conduction particle is used. In order not to show conductivity in the state of un-pressurizing, this connection material is not short-circuited, even if a connection pitch will make it detailed and connection materials will contact. However, in this structure, the trouble that the production process which forms a connection material is complicated, and that manufacturing cost also becomes high arises.

[0004] Moreover, since separate a mask and an electric conduction particle is arranged, after sticking the mask which has a through tube in a position on the member which has surface viscosity and putting in an electric conduction particle in said through tube, there are some which were imprinted on the electrode terminal after that as an example of the advanced technology in addition to this and an electric conduction particle is arranged only on an electrode by this, a lateral short circuit does not occur. However, since what formed the metal membrane in the resin particle surface as an electric conduction particle is used, when [which put in a particle in the through tube of a mask] a through tube end face, a particle migration means end face, etc. contact an electric conduction particle in process, destruction or exfoliation of said metal membrane may arise, and a faulty connection may occur.

[0005]

[Problem(s) to be Solved by the Invention] This invention was made in view of the above actual

condition, and makes it to offer the formation method of the connection structure of an electrode pattern where reliable connection can be made with the cheaply sufficient yield also in a detailed connection pitch that technical problem that should be solved with the conductor made to arrange using the array method easily and that the detailed array of a minute body can be ensured, and this array method.

[0006]

[Means for Solving the Problem] A production process at which invention of claim 1 irradiates ultraviolet rays at a part of adhesive layer which consists of ultraviolet curing mold resin prepared on a base, said adhesive layer of this exposure portion is stiffened, and adhesion is reduced, It is characterized by having a production process which contact a minute body all over said adhesive layer, and said minute body is made to adhere to a non-glaring portion of said ultraviolet rays, and is arranged, and a production process which removes an unnecessary minute body adhering to said exposure portion.

[0007] A production process to which a minute body is made to adhere all over an adhesive layer which consists of ultraviolet curing mold resin which prepared invention of claim 2 on a transparent base, A production process at which ultraviolet rays are irradiated from a back side of said base at said a part of adhesive layer at said a part of adhesive layer, said adhesive layer of this exposure portion is stiffened, and adhesion is reduced, It is characterized by having a production process which removes said minute body of said exposure portion, and arranges said minute body into a non-glaring portion of said ultraviolet rays.

[0008] Invention of claim 3 is characterized by having a production process which pattern-izes with photolithography a photoresist layer prepared on a base, and a production process which a minute body is made to adhere to this adhesive layer by using as an adhesive layer said said photoresist layer which was pattern-ized and remained on said base, and is arranged.

[0009] A production process to which a minute body is made to adhere all over the 1st adhesive layer which consists of ultraviolet curing mold resin which prepared invention of claim 4 on the 1st transparent base, A production process which piles up the 2nd base which prepared the 2nd adhesive layer of low adhesion from said 1st adhesive layer, and said 1st base to which said minute body was made to adhere, A production process at which ultraviolet rays are irradiated from a back side of said 1st base made to pile up mutually at said a part of 1st adhesive layer, the 1st adhesive layer of this exposure portion is stiffened, and adhesion is reduced, It is characterized by exfoliating said 1st base from said 2nd base, and having a production process which makes a minute body of said exposure portion on said 1st base imprint and arrange on said 2nd base.

[0010] In a formation method of connection structure to which it was made for invention of claim 5 to connect electrically an electrode terminal on the 1st wiring substrate, and an electrode terminal on the 2nd wiring substrate through a conductor Said 1st wiring substrate and said 2nd wiring substrate It is characterized by being fixed by the 1st adhesives with which it filled up between said each wiring substrate, and fixing said conductor by the 2nd adhesives which it is made to make exist only in said field which connects electrically, and were formed at least in one side of each of said electrode terminal.

[0011] Invention of claim 6 as a production process which obtains said the 1st or 2nd one of wiring substrates with which a conductor was arranged on an electrode terminal used in a formation method of connection structure according to claim 5 by the array method of a minute body claim 1 - given [any 1] in three A production process which arranges a conductor applicable to said minute body on the 1st base which prepared the 1st adhesive layer, A production process which imprints said conductor for the 2nd base with which the 2nd adhesive layer of high adhesion was prepared rather than said 1st adhesive layer, and said 1st base which said conductor arranged to said 2nd base according to adhesion of superposition and said 2nd adhesive layer, It is characterized by making it have a production process which said conductor is imprinted [production process] on said electrode terminal by adhesive strength of superposition and said adhesives, and makes said wiring substrate equipped with an electrode terminal with which adhesives were formed in the surface, and said 2nd base with which said conductor was imprinted arrange.

[0012] Invention of claim 7 as a production process which obtains said the 1st or 2nd one of wiring

substrates with which a conductor was arranged on an electrode terminal used in a formation method of connection structure according to claim 5 by the array method of a minute body according to claim 4 A production process which arranges a conductor applicable to said minute body on said 2nd base, It is characterized by making it have a production process which said conductor is imprinted [production process] on said electrode terminal by adhesive strength of superposition and said adhesives, and makes the 1st [said] wiring substrate equipped with an electrode terminal with which adhesives were formed in the surface, and said 2nd base which said conductor arranged arrange.

[0013] In a formation method of connection structure according to claim 6 or 7, said 2nd base is transparent, said 2nd adhesive layer consists of ultraviolet curing mold resin, and invention of claim 8 irradiates ultraviolet rays at the time of said imprint, reduces adhesion of said 2nd adhesive layer, and is characterized by performing said imprint easily.

[0014] Invention of claim 9 as a production process which obtains said the 1st or 2nd one of wiring substrates with which a conductor was arranged on an electrode terminal used in a formation method of connection structure according to claim 5 by the array method of a minute body according to claim 1 or 2 A production process which arranges a conductor applicable to said minute body on a transparent base, and said wiring substrate equipped with an electrode terminal with which adhesives were formed in the surface and said base which said conductor arranged Superposition, Ultraviolet rays are irradiated from a back side of said base, said adhesive layer is stiffened, adhesion is reduced, and it is characterized by making it have a production process which makes said conductor imprint and arrange on said electrode terminal.

[0015] In a formation method of connection structure according to claim 8 or 9, invention of claim 10 uses said adhesives as ultraviolet curing mold adhesives, and is characterized by making it paste up said electric conduction particle and said adhesives firmly by ultraviolet rays which glare at the time of said imprint.

[0016]

[Embodiment of the Invention] The operation gestalt of the array method of a minute body that this invention is applied to below, and the formation method of connection structure is concretely explained with reference to the attached drawing. In addition, in the complete diagram for explaining an operation gestalt, what has the same function attaches the same sign, and explanation of the repeat is omitted.

Drawing 1 is drawing for explaining invention of claim 1, and shows the cross section of 1 operation gestalt of law according to a production process an arranged part of a minute body. For a base and 2, as for a mask and 4, an ultraviolet curing mold resin layer (adhesive layer) and 3 are [one / ultraviolet rays and 5] minute bodies among drawing. As shown in drawing 1 (A), the adhesion member (for example, dicing tape by the Furukawa Electric Co., Ltd. (UC1827)) which has the ultraviolet curing mold resin layer 2 is prepared, and as shown in this at drawing 1 (B), ultraviolet rays 4 are irradiated more than the amount of conventions through the mask 3 which prepared the ultraviolet-rays transparency section and the shielding section. Thereby, the ultraviolet curing mold resin layer 2 of the portion which has irradiated ultraviolet rays is hardened, and loses adhesiveness. Said adhesion member is pressed against the portion in which the minute body 5 is arranged all over the ultraviolet curing mold resin layer 2 side, a pressure is lightly applied to in this condition as shown in drawing 1 (C), or the minute body 5 is accumulated. Thereby, the minute body 5 is fixed to ultraviolet-rays the non-glaring section by the adhesion which original has [the ultraviolet curing mold resin layer 2]. Although a minute body may adhere also to the UV irradiation section in part, it is removable by giving an air blow or vibration lightly to an adhesive face. Therefore, after passing through these production processes, as shown in drawing 1 (D), the minute body 5 is fixable only to ultraviolet-rays the non-glaring section of said adhesion member. here, since there is adhesion, as for the ultraviolet curing mold resin layer 2, it is desirable to use the stepper whom it usually comes out to detach a mask 3 and to irradiate it, there is, and it uses in a semiconductor process.

[0017] Moreover, the dicing tape mentioned above has a three-tiered structure which usually stuck the separator on the base material surface on the ultraviolet curing mold resin layer which carried out coating formation. Therefore, since the gap of a mask and an ultraviolet curing mold resin layer becomes

almost fixed by adopting the method of irradiating ultraviolet rays where a mask is stuck on a separator, without exfoliating a separator, special equipment is not needed but fixed pattern formation can be performed. Moreover, since the base material of such a dicing tape itself is transparent, the same effect can be acquired also by glaring similarly from the back of an adhesive face.

[0018] Drawing 2 is drawing for explaining invention according to claim 2, and shows the cross section of other operation gestalten of the array method of a minute body according to a production process. The minute body 5 is arranged all over the ultraviolet curing mold resin layer 2 which this adhesion member has using the same adhesion member as the operation gestalt shown in drawing 1, or the whole surface is covered with the minute body 5, and this member is pressed here. This will be in the condition that the minute body 5 adhered all over the ultraviolet curing mold resin layer 2, as [show / in drawing 2 (B)]. Subsequently, as shown in drawing 2 (C) from the back of this adhesive face, the amount exposure of conventions of the ultraviolet rays 4 is carried out through a mask 3. By this, ultraviolet rays will penetrate the transparent base 1, the ultraviolet curing mold resin layer 2 will be reached, this resin layer of the exposure section will be hardened, and adhesion will be lost. The minute body 5 adhering to an exposure field is removable by giving an air blow or vibration to the surface of the ultraviolet curing mold resin layer 2 in this condition. Therefore, after passing through these production processes, as shown in drawing 2 (D), the minute body 5 can be fixed and arranged only in ultraviolet-rays the non-glaring section on an adhesion member.

[0019] Drawing 3 is drawing for explaining claim 3, and shows the cross section of the operation gestalt of further others of the array method of a minute body according to a production process. 1' is a substrate among drawing and 6 is a resist layer. First, as shown in drawing 3 (A), a photoresist layer 6 is formed on substrate 1' without adhesion of glass etc. as the photoresist at this time -- the thing of an emulsion system -- desirable -- for example, Tokyo -- adaptation -- an incorporated company BMR resist is raised. Next, as shown in drawing 3 (B) and drawing 3 (C), it patternizes so that it may leave a resist field only to a location [a location] to make it arrange a minute body for this FETO resist layer 6 according to a photolithography process. As shown in drawing 3 (D), substrate 1' is pressed to the portion in which the minute body 5 has been arranged all over substrate 1' formed in this way, or the whole surface was covered with the minute body 5. Since it has some adhesion, a photoresist of the same kind can carry out array maintenance of the minute body only at the photoresist section, as shown in drawing 3 (E).

[0020] Drawing 4 is drawing for explaining claim 4, and shows the cross section of the operation gestalt of further others of the array method of a minute body according to a production process. Seven are the 2nd adhesion member among drawing. Here, as shown in drawing 4 (A), the same adhesion member as the operation gestalt shown in drawing 1 is prepared, and as shown in drawing 4 (B), said adhesion member is pressed to the portion in which the minute body has been arranged all over the ultraviolet curing mold resin layer 2, or the whole surface was covered with the minute body. This will be in the condition that the minute body adhered all over the ultraviolet curing mold resin layer 2. This adhesion member has a transparent base 1, as mentioned above, it is in this condition, and as shown in drawing 4 (C), it presses the 2nd adhesion member 7 which has adhesion weaker than said adhesion member. As a material suitable for this adhesion member 7, silicone rubber is specifically raised. Here, the amount exposure of conventions of the ultraviolet rays 4 is carried out from the back of a base 1 all over the ultraviolet curing mold resin layer 2 only at the portion which makes the minute particle 5 arrange. Thereby, the ultraviolet curing mold resin layer 2 of the exposure section is hardened, and loses adhesion. After that, if both are separated as shown in drawing 4 (D), although the minute body 5 of the ultraviolet-rays the non-glaring section has adhered to the ultraviolet curing mold resin layer 2, the minute body 5 of the UV irradiation section is imprinted to the 2nd adhesion member 7 side, and can arrange a minute body to up to the 2nd adhesive member 6 as a result.

[0021] Although it ends here, 1 cycle of an array production process can be again pressed against a base 1, and can make the same array form on the 2nd adhesion member 7 from shifting the location of a mask 3 and irradiating ultraviolet rays 4 here, as the minute body 5 arranged on the 2nd adhesion member 7 is moved to other locations and it is shown in drawing 4 (E) thru/or drawing 4 (G). Such a method enables

it to raise the use effectiveness of the minute body 5.

[0022] Drawing 5 is the cross section showing the connection structure of the electrode pattern for explaining claim 5, and the same sign as drawing 6 is given to the portion which carries out the same operation as drawing 6 among drawing. The 1st wiring substrate 11 and the 2nd wiring substrate 12 have the electrodes 13 and 14 which should be connected to each substrate side. The adhesives layer 16 is formed at least in one side of these electrode surfaces, and the conductive particle 15 is being fixed to it in the form inserted into two electrodes by this adhesives layer 16. The gap portion of others between these substrates is filled up with the insulating adhesives 17, and, thereby, both substrates are joined to it. At this time, the conductive particle 15 has structure which exists only on the electrodes 13 and 14 which should be connected. With such structure, even if it narrows an electrode spacing, lateral electric contact cannot occur easily.

[0023] An electric conduction particle imprints the electric conduction particle (minute body) arranged by using the array method given in four from claim 1 on the array member (base which prepared the adhesive layer) to an imprint member side according to the difference of both adhesion by dissociating, after piling up with an imprint member (base which prepared the 2nd adhesive layer) with bigger adhesion than the adhesion of this array member. And after positioning the imprint member which this electric conduction particle arranged so that a conductive particle may come on the electrode of a substrate, this imprint member and this substrate are piled up. The adhesives currently formed in the electrode surface in the condition are hardened, and the electric conduction particle on an imprint member is fixed on an electrode. Then, an electric conduction particle can be arranged on an electrode by separating a substrate and an imprint member. At this time, as shown in claim 8, after piling up on an electrode using a dicing tape which was mentioned above as an imprint member, it can imprint easily to up to an electrode by irradiating ultraviolet rays from the back side of an adhesive face.

[0024] After making an electric conduction particle arrange on it, using a dicing tape as the above-mentioned array member, in order to harden the resin of the whole array member surface, an electric conduction particle is imprinted on an electrode by irradiating ultraviolet rays from a rear face, after piling up on the electrode of a direct substrate. By this method, an imprint member and an imprint production process can be skipped (claim 9).

[0025] In case UV irradiation is performed on an electrode and an electric conduction particle is imprinted, the adhesives of an ultraviolet curing mold are applied on the electrode. Thereby, by performing UV irradiation at the time of an imprint, the adhesives on an electrode can harden and an electric conduction particle can certainly be fixed (claim 10).

[0026]

[Effect of the Invention]

The effect of claims 1 and 2: Since it is the method of controlling the adhesion of an adhesive layer and arranging a minute body by irradiating ultraviolet rays and the exposure pattern of ultraviolet rays can determine the array of a minute body, a minute body can be arranged easily and certainly.

[0027] The effect of claim 3: Since the field which makes a particle arrange with photolithography is formed, a more detailed array is realizable.

[0028] The effect of claim 4: Since he is trying to use for an imprint and an array the minute body of only the UV irradiation section on the base with which the minute body was arranged on the whole surface, by imprinting shifting a base at the time of UV irradiation, an imprint and array of multiple times are possible at the same base, and the use effectiveness of a particle can be raised.

[0029] Claim 1 thru/or 4 effects: Since the array of a minute body can be collectively formed in the field on a base, it cannot be concerned with the configuration of an array, and the number of the bodies made to arrange, but an array can be acquired at the same production process.

[0030] The effect of claim 5: Since he is trying for a conductor to exist only on the electrode which should be connected, even if a connection pitch becomes detailed, it does not connect too hastily, and connection of high density can be made.

[0031] The effect of claim 6: Since he is trying to imprint again on an electrode after imprinting the electric conduction particle arranged on the 1st base through the UV irradiation production process on

the 2nd base, the 1st base can imprint multiple times by one sheet, and a manufacturing cost can be reduced.

[0032] The effect of claim 7: Since the array method according to claim 4 is used, the particle made to adhere to the whole surface can be used for array formation of multiple times, the use effectiveness of a particle is high and mounting cost can be reduced.

[0033] The effect of claim 8: Since the holding power of an electric conduction particle becomes weaker by performing UV irradiation to the base with which the electric conduction particle is arranged in case an electric conduction particle is imprinted on an electrode, an electric conduction particle can be more certainly arranged on an electrode.

[0034] The effect of claim 9: Since the base which the electric conduction particle is making arrange is imprinted on a direct substrate, an electric conduction particle is imprinted on an electrode in piles and the imprint production processes which could omit the 2nd base for imprinting and used this are reducible, a manufacturing cost can be reduced.

[0035] The effect of claim 10: Since the adhesives applied on an electrode are ultraviolet curing molds, by performing UV irradiation at the time of the imprint of an electric conduction particle, and stiffening adhesives, an electric conduction particle is certainly fixed on an electrode, and reliable connection structure can be acquired.

[Translation done.]

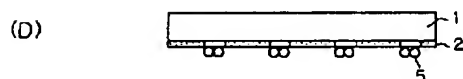
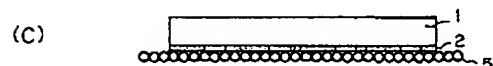
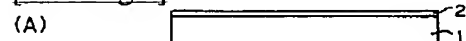
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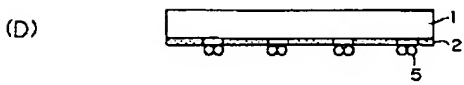
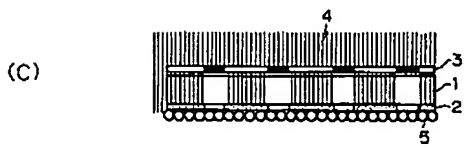
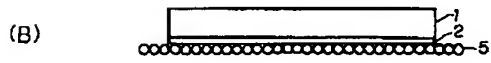
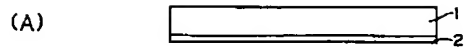
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2. **** shows the word which can not be translated.
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DRAWINGS

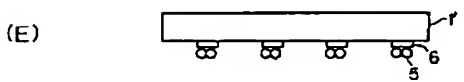
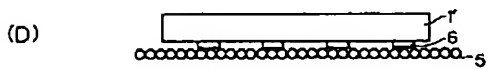
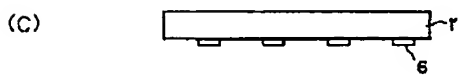
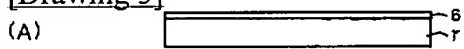
[Drawing 1]



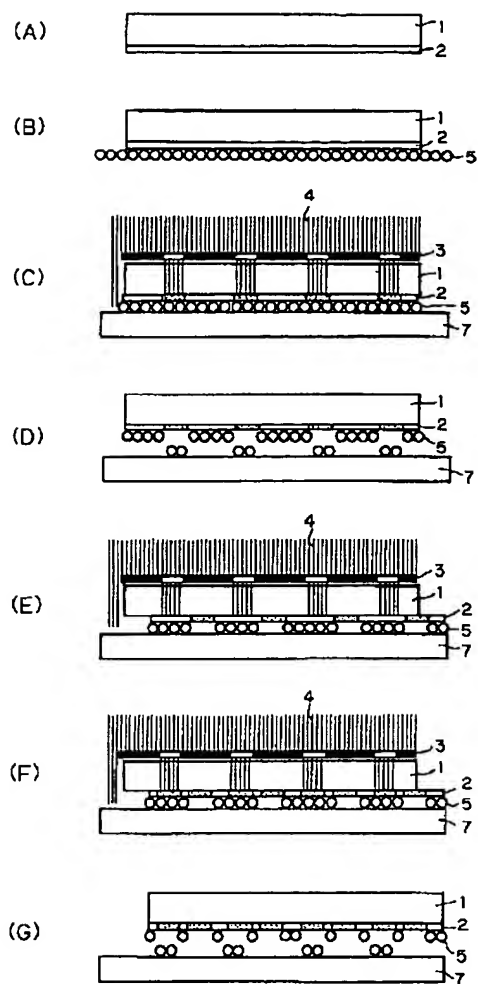
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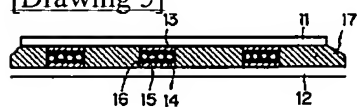
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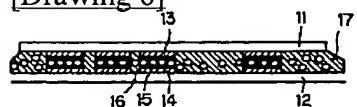
[Drawing 4]



[Drawing 5]



[Drawing 6]



[Translation done.]